PAN-PACIFIC ENTOMOLOGIST
October 1982, Vol. 58, No. 4, pp. 284–287
Published 30 December 1983

BIOLOGICAL NOTES ON *ANDRENA* (*CALLANDRENA*) *HAYNESI* VIERECK AND COCKERELL (HYMENOPTERA: ANDRENIDAE)

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In the summer of 1980, both sexes of *Andrena haynesi* Viereck and Cockerell were collected from sunflower that grew on sand dunes in southeastern Utah's San Rafael Desert. The recorded distribution area of this large, dark-colored andrenid bee includes the western great plains (LaBerge 1967), but specimens from northeastern Arizona are in the USDA Bee Laboratory collection at Logan, Utah. The specimens reported in this study are the first records of this bee from Utah.

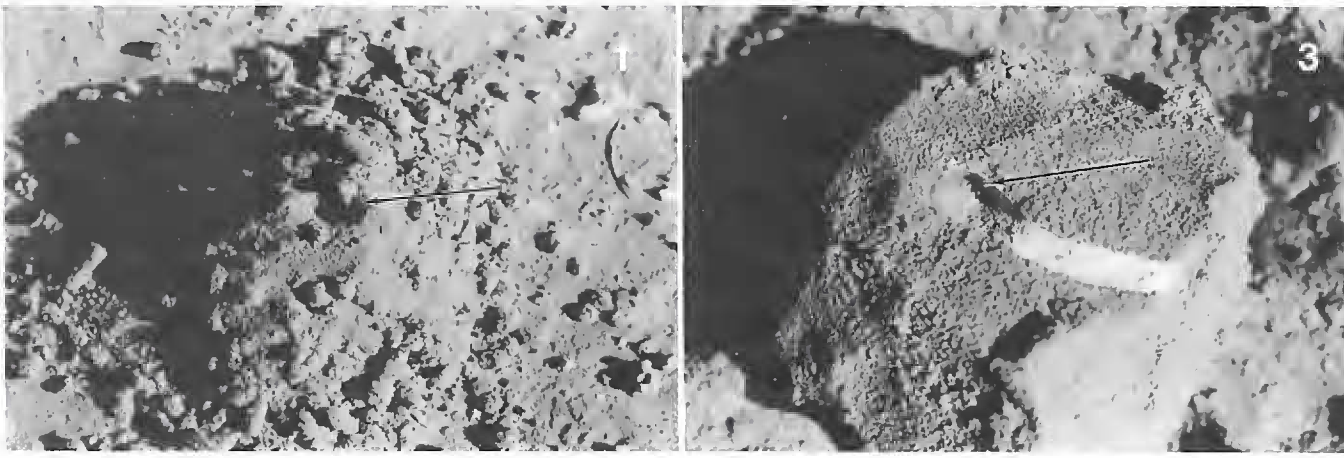
During August and September, we found many newly constructed nest mounds of *A. haynesi* on the sand dunes near the sunflower patches where the bees foraged. Thus, we were able to observe and record some aspects of the biology of this sunflower bee. There is little biological information about *Callendrena,* the subgenus where *A. haynesi* is placed. For example, nests of only 2 of the 52 United States species have been described (Rozen, 1973; Parker and Bohart, 1983).

Nesting Site

We found many of the nest mounds on the bare, windward side of crescent dunes located on both sides of Highway 24, approximately 20 miles north of Hanksville, Utah. Another nest concentration was found on the north slope of a hill that borders a wash about one mile northwest of Goblin Valley State Park, Utah, a location approximately seven miles from the first one. Most of the nests at this latter site were scattered among small shrubs of *Eriogonum* where the soil surface was firmer than that of the dunes. We also found some nests in hard-packed sand along an old road. Adjacent to both nesting sites were large patches of the sunflower, *Helianthus anomalus* Blake.

Nest Architecture

Tumulus.—The nest entrances were characterized by large mounds of excavated dirt surrounding the openings (Fig. 1). These tumuli were much larger than nest mounds of other mining bees we have seen. The steep-sided, cone-shaped mounds measured 8.9–10.2 cm wide and 3.8–4.4 cm high. Entrances of most nests were in the center of the tumulus, but they were at



Figs. 1, 3. *Andrena haynesi.* Fig. 1. Nest tumulus. Fig. 3. Cell with loose pollen and partial pollen ball.

the side in older nests, probably because rain had weakened the turrets, causing them to fall on their sides. All new nests had a turret within and extending to the base of the tumulus that the bees had made by cementing 8–15 mm of soil around the nest entrance (Fig. 2). We collected several females that were in the turret just below the plug in the nest entrance by

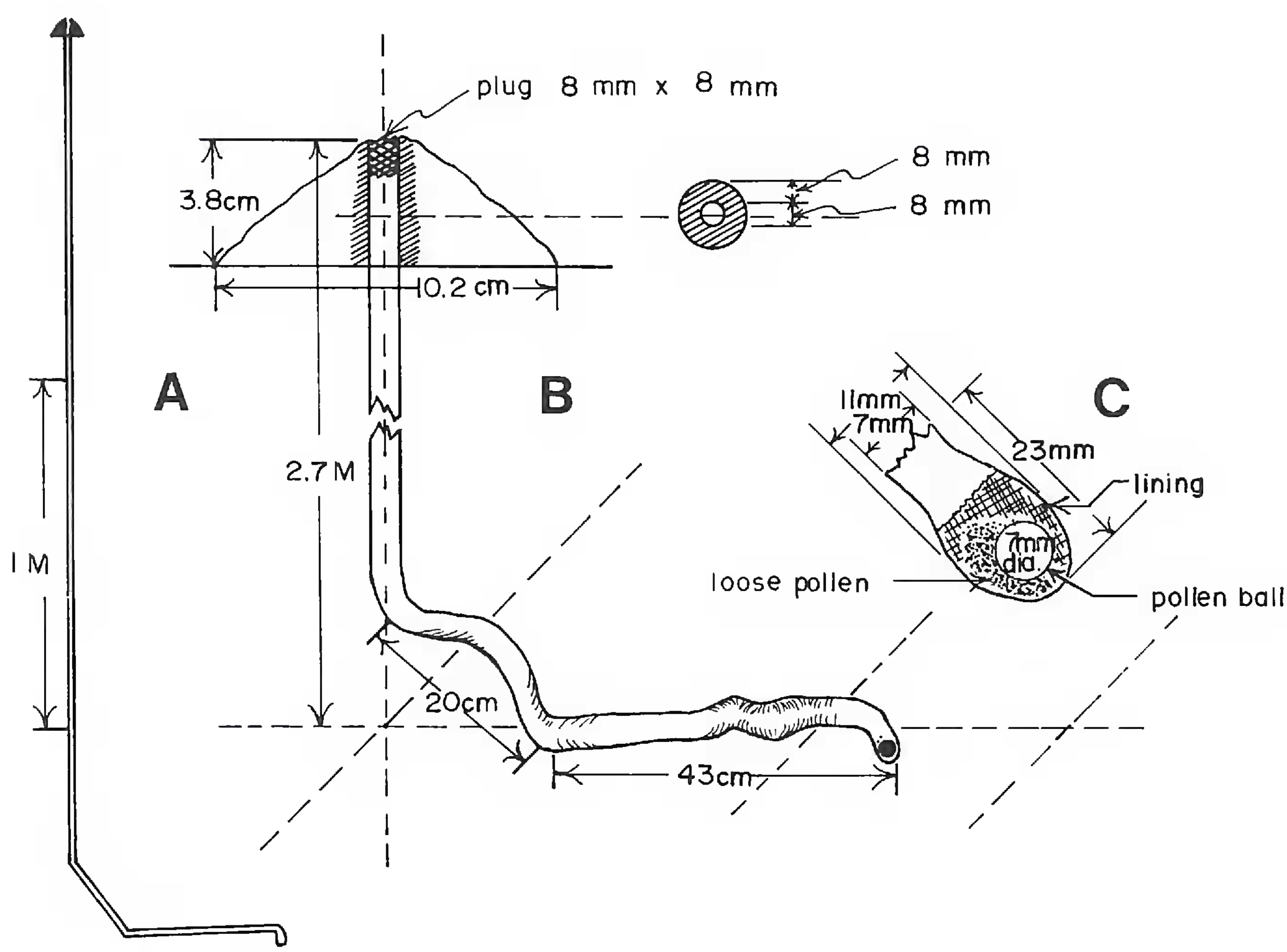


Fig. 2. *Andrena haynesi* nest architecture: A = entire nest diagram; B = details of tumulus, turret, and lateral burrow; C = cell.

quickly brushing the turret away from the main burrow. The 8-mm wide nest entrance was closed by a 5–9 mm thick plug of moist sand except when the female was actively foraging.

Burrow.—We excavated only one burrow because of their extraordinary depths. The main burrow was the same diameter as the entrance, and the walls were smooth. It descended vertically for 2.35 m and then sloped to the east in a 45° spiral for 20 cm. At this point, the main burrow was 2.7 m below the soil surface. From the main burrow, a lateral burrow extended eastward for 43 cm and ended in a single cell.

While the first nest was being excavated, which took about 7 hours, we estimated the depth of the main burrows of other nests by removing the tumulus and lowering a weighted string down the large hole. All of the nests we measured had been plugged at the entrance. The main burrows of five nests descended vertically 2.1–2.2 m below the surface. Other nests were considerably shorter, only .5–1.3 m deep. After the bees replugged the entrance of the shallower nests, we remeasured the burrows. In all cases, the string dropped to a greater depth the second time, suggesting that the main burrow is plugged at various intervals, and the bees use the sands from these plugs to reseal the nest entrance.

Cell.—A single horizontal, but incomplete cell was found; it measured 23-mm long and 11-mm wide (Fig. 3). The basal two-thirds of the cell was coated with a thick waxy material. This cell, which was in the process of being provisioned (the female was captured as she returned to the nest with a pollen load), contained several loads of loose pollen and a spherical pollen-nectar ball that was 7 mm in diameter (Fig. 2). The pollen was 100% *Helianthus.* The soil temperature at the cell depth was 67°F (19°C).

Observations on Adults

Five female *Andrena* were observed making foraging trips. During the foraging period, the bees always left the nest entrance open. The temperature when some bees began foraging was only 47°F (8°C) because they opened their nests as early as 6:27 a.m. (September 16). (It was still too dark for us to see without the aid of a lantern.) We also observed an undescribed species of *Nomada* (*Pachynomada*) leaving an unplugged nest of *A. haynesi* early in the morning. This parasite has been reared from cells of *Andrena helianthi* Robertson, at Logan, Utah (Parker and Bohart, 1983).

The time the bee spent out of the nest to gather a pollen load averaged 12 min 6 sec (10 min 24 sec to 14 min 51 sec), and the time spent within nests between trips averaged 2 min 50 sec (2 min 5 sec to 3 min 42 sec). The time the bees spent at the sunflower head averaged 32.1 sec (2–88 sec, $n = 27$). The female landed directly on the disk flowers, near the margin, and then worked the ring of newly dehisced anthers in a circular pattern, with some bees making more than one circuit. The foraging period ended between 8:30 and 9:15 a.m. when the nest entrances were replugged; no further activity was seen at these nests.

Discussion

The nests of *A. haynesi* are deeper than nests of any other recorded North American bee, probably an adaptation of this species to their environment. First, these bees nest in shifting sand dunes that are several feet above the surrounding soil surface. Deep nests would protect the bee cells when the dunes shifted from the nesting site. For example, 12 *Andrena* nests were marked in August, but when we returned in September, all of the nest markers and 7 of the nest turrets had been blown away; nevertheless, 5 of the original nests were still active. Second, these bees are matinal oligoleges of sunflower and forage during the coolest time of the day. Perhaps the higher soil temperature in these deep nests enables the bees to maintain their body temperature at the flight threshold so that they can forage early in the day at cold temperatures. It is also possible that there are soil moisture requirements for bee development and that this depth places the cells below the maximum level of dry sand even in drought years.

The basic pattern of *A. haynesi* nest construction is similar to that of *A. helianthi,* a related *Callandrena* that is also an oligolege of sunflower (Parker and Bohart, 1983). The nests of *A. helianthi* were not as deep and the lateral burrows were shorter than those of *A. haynesi. Andrena accepta* Viereck, the only other biologically known *Callandrena,* has communal nests (Rozen, 1973).

Acknowledgments

We would like to thank D. Veirs of this laboratory for his assistance in the field work and for the illustrations. Drs. N. Youssef, Department of Biology, Utah State University, and W. LaBerge, Illinois Natural History Survey, Natural Resources Building, Urbana, offered helpful suggestions for improving this manuscript.

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